Cardiol Ther (2014) 3:67–71
DOI 10.1007/s40119-014-0026-7

CASE REPORT

Aorta-to-Left Atrial Fistula Caused by Air Gun Pellet Cardiac Injury

Mustafa K. Avsar · Serafettin Demir · İbrahim Özgür Önsel · Huseyin H. Poyrazoglu

To view enhanced content go to www.cardiologytherapy-open.com
Received: October 19, 2013 / Published online: March 5, 2014

ABSTRACT

Abnormal communication between the ascending aorta and the cardiac chambers is rare, diverse in origin, and can be congenital or acquired. We report a case of a 10-year-old boy with acquired aorta-to-left atrial fistula associated with an air gun pellet injury and his successful treatment.

Keywords: Penetran cardiac trauma; Aorta-to-left atrial fistula; Air gun pellet; Cardiac injury

Electronic supplementary material The online version of this article (doi:10.1007/s40119-014-0026-7) contains supplementary material, which is available to authorized users.

M. K. Avsar (✉)
Department of Cardiolovascular Surgery, Medicana International Hospital, Beylikdüzü, Istanbul, Turkey
e-mail: mustafakemalavsar@hotmail.com

S. Demir
Department of Cardiology, Adana State Hospital, Adana, Turkey

İ. Ö. Önsel
Department of Anaesthesiology, Medicana International Hospital, Beylikdüzü, Istanbul, Turkey

H. H. Poyrazoglu
Department of Cardiolovascular Surgery, Cukurova University, Adana, Turkey

INTRODUCTION

Aortico-cameral communication is relatively uncommon. Tract formation between the aorta and the left atrium is rare. This formation can have congenital origins or it can be acquired. Virtually all reported aorto-cardiac fistulas involve communications between the aorta and the right atrium, right ventricle, or left ventricle and have been causally associated with bacterial endocarditis, paravalvular abscess, ruptured sinus of Valsalva aneurysm, and aortic dissection. Most of them are usually acquired in the presence of, and associated with, aneurysms of the sinus of Valsalva [1]. Another more rare cause is the penetrating cardiac trauma. In this study, we report a case of a 10-year-old boy with aorta-to-left atrial fistula attributed to an air gun pellet cardiac injury.

CASE REPORT

A 10-year-old boy presented to our outpatient clinic with New York Heart Association (NYHA) class II dyspnea on exertion. On physical

examination, his pulse rate was regular at 110 beats/min, blood pressure was 100/60 mmHg, and respiratory rate was 24 breaths/min. The patient had a well-healed sternotomy scar. Cardiac auscultation demonstrated a grade 2–3/6 ejection systolic and diastolic murmurs, heard best at right second–third intercostal spaces. A careful patient history revealed that a shot from an air gun pellet accidentally hit the patient's anterior left fourth intercostal space 30 days previously. Hospital records indicated that he had undergone an operation following a diagnosis of cardiac tamponade. The hematoma in the pericardial sac was drained via sternotomy and no intracardiac injury was suspected. He was operated on in another hospital, which could not be reached for further information.

On presentation at our clinic, the lungs were clear to auscultation and percussion. Chest roentgenogram demonstrated complete opacification of the left hemi-thorax; there was no cardiomegaly. There was no abnormality in the electrocardiographic findings except left ventricular hypertrophy. The color flow echocardiography revealed abnormal flow (the flow was continuous), suggestive of an abnormal communication between the aorta and the left atrium, with mild-to-moderate aortic regurgitation and a hyperechogenic appearance that suggested the existence of a pellet in the interventricular septum in the apical area (Fig. 1). Therefore, we decided to perform a cardiac catheterization.

Catheterization demonstrated abnormal flow from the aorta to the left atrium, confirming our suspicions and demonstrating an aorta-to-left atrial fistula (Fig. 2). Under general anesthesia, median resternotomy and aorta and bicaval cannulation were performed. After systemic heparinization, cardiopulmonary bypass was started. The cross clamp was placed to allow direct visualization of the injury, and cardiac arrest was performed using isothermic blood cardioplegia to direct coronary ostia after aortotomy. A fistula in the left coronary sinus proceeding to the left atrium was spotted (Fig. 3). The left coronary cusp was discovered to be ruptured. Left ventriculotomy was made from apex of heart because the pellet was among papillary muscles. The apical septum was explored and the pellet removed from the septum. The fistula in the left coronary sinus was closed with a 6/0 prolene pericardial patch by continuous suture. Transthoracic echocardiogram was performed 2 days after the operation. The color flow echocardiography revealed no abnormal flow between the aorta and left atrium. The patient without complications was discharged from the hospital 4 days after the operation. The postoperative period was uneventful. Postoperative echocardiographic and Doppler examination did not reveal the aorta–left atrial fistula. Three months after the operation, the patient was in good condition and his functional capacity according to the NYHA was Class I. No problem was detected throughout the 5-year follow-up.

Informed consent was obtained from the patient for being included in the study. This article does not contain any studies with human subjects performed by any of the authors.

DISCUSSION

Aorta-to-left atrial fistula is rare and its causes can be congenital or acquired. Acquired causes include bacterial endocarditis, paravalvular abscess, ruptured sinus of Valsalva aneurysm, aortic dissection, atherosclerosis, previously undergone coronary bypass surgery operation, and penetrating traumas, although these are less likely.

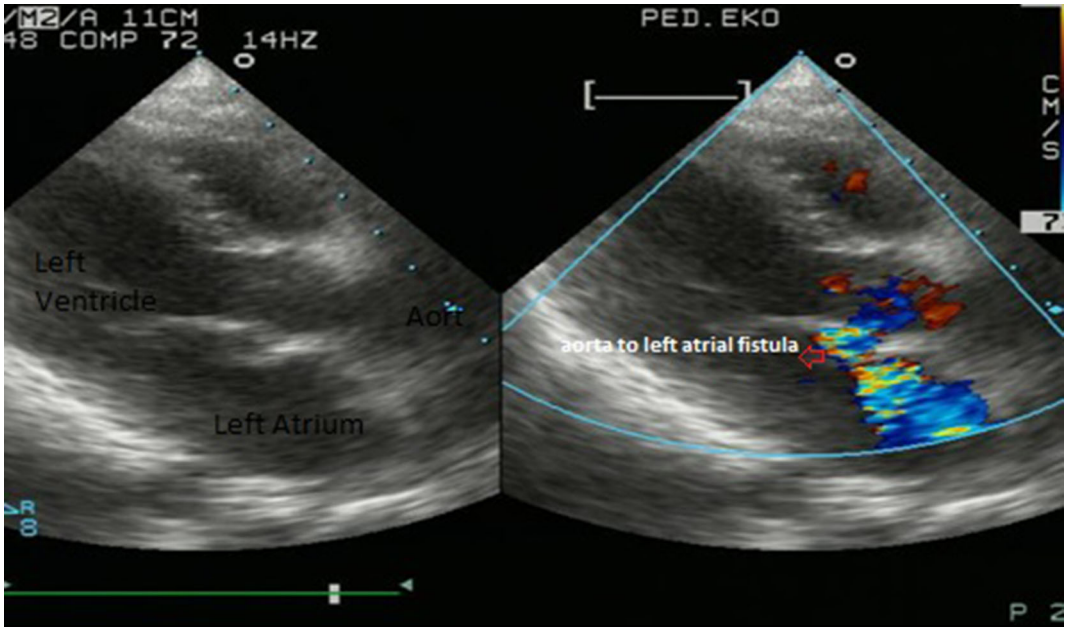

Fig. 1 Pre-operative echocardiography

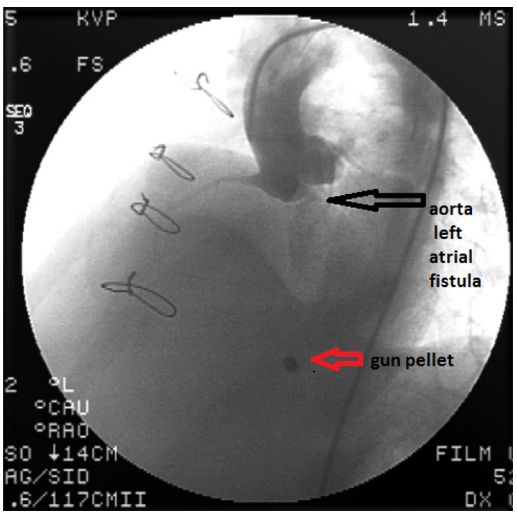

Fig. 2 Aorta-to-left atrial fistula and gun pellet images with catheterization

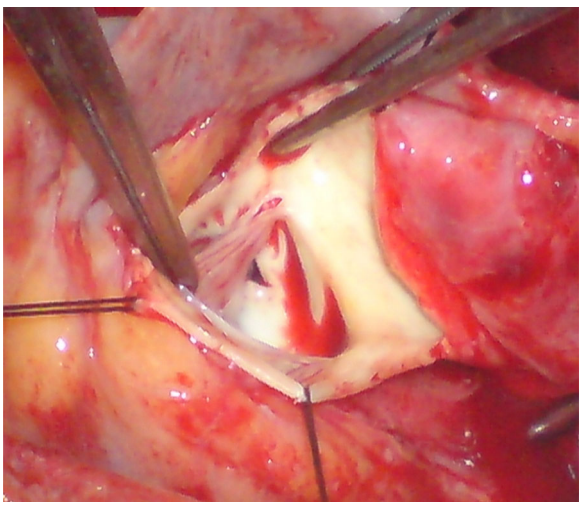

Fig. 3 Intraoperative aorta-to-left atrial fistula picture. The patient is positioned so that the toe-side is on the *left* of the figure and head-side on the *right*

Acquired aorta-to-left atrial fistula is usually fatal. Aorta-to-left atrial fistula of the heart associated with penetrating traumas carries a higher mortality risk. Of all reported aorta-to-left atrial fistula cases, penetrating traumas are the least common. Penetrating trauma can be classified as a stab wound or a gunshot wound. Stab wounds and gunshot wounds have approximately equal incidence among patients transported to the emergency department and a mortality rate of 10–60% [2]. Gunshot wounds of the heart carry a 2–4 times higher mortality than stab wounds [2]. The right ventricle is affected more often than

the left ventricle due to its anterior anatomic location. The left or right atrium is affected in 20% of cases. A third of penetrating cardiac wounds affect multiple chambers, and survival rates are much lower in these cases. Our patient had single pellet hole in the left posterolateral fourth intercostal space and a ventricular injury was anticipated. However, to our surprise, the pellet was stuck to the left ventricular septum after traveling through the aorta forming a tract between the left coronary sinus and the left atrium. Our patient had undergone an operation with a prognosis of cardiac tamponade in a different hospital and no intracardiac injury was suspected. No echocardiography was performed before or after the operation. The heart injury could not be recognized since there was no visual detection of a cardiac wound during the operation. Preoperative echocardiography should be performed in patients who have suffered a penetrating injury to the heart. If this is not possible, intraoperative echocardiography is essential in order to determine the location of the bullet or pellet, since they may not follow a predictable route. However, bullets usually do follow a relatively straight route unless deviated by tissue.

The patient's wound was on the left, just above the heart and beside the sternum in the fourth intercostal space which is the most risky area in the chest wall for a heart injury [3]. Surgeons are strongly advised to always consider the possibility of cardiac and intracardiac injuries for this type of wound. The patient underwent an operation on a diagnosis of cardiac tamponade and was discharged from the hospital. Intracardiac injuries were not suspected. Owing to the fact that he had a minor shunt (left–right) and a mild–moderate aortic regurgitation, the potential for future postoperative complications could have gone unaddressed had we not noticed it during the outpatient clinic exam. However, in the long term, it is understood that the shunt amount and aortic regurgitation would have grown in severity. Moreover, if the aorta–left atrial fistula was not fixed, it is likely the patient would have suffered severe aortic regurgitation [4, 5]. Ultimately, the patient would have entered the operation theater in a worse condition, and the procedure would have had less benefit. Irreversible damage would have already commenced, regardless of aorta-to-left atrial fistula closure and procedures to repair the damage, such as aortic valve transplant. The tolerance of the heart stemmed from the relatively small shunt amount (left–right) that the pellet caused.

Heart injuries can be fatal, particularly if not promptly recognized. Acquired aorta-to-left atrial fistula cases (bacterial endocarditis, paravalvular abscess, ruptured sinus of Valsalva aneurysm, aortic dissection, and atherosclerosis) are encountered mostly along autopsy series. The literature has revealed a different penetrating heart injury case (gunshot) in which the patient suffered congestive heart failure after 20 years [5]. Our patient was operated on following the detection of a ruptured sinus of Valsalva aneurysm and aorta-to-left atrial fistula via echocardiography. To our knowledge, this case perhaps represents the first reported aorto-left atrial tract resulting from penetrating cardiac trauma by an air gun pellet.

ACKNOWLEDGMENTS

All named authors have met the ICMJE criteria for authorship for this manuscript, have given final approval to the version to be published, and take responsibility for the integrity of the

work as a whole. No funding or sponsorship was received for this study or publication of this article.

Conflict of interest. Mustafa K. Avsar, Serafettin Demir, İbrahim Özgür Önsel and Huseyin H. Poyrazoglu declare no conflict of interest.

Compliance with ethics guidelines. Informed consent was obtained from the patient for being included in the study. This article does not contain any studies with human subjects performed by any of the authors.

REFERENCES

1. Topcuoğlu MS, Salih OK, San M, Kayhan C, Ulus T. Aorta–left atrial fistula with bicuspid aortic valve and coronary artery origin anomaly. Ann Thorac Surg. 1997;63:854–6.

2. Belgi A, Mete A, Avşar O, Topuzoğlu FS. Penetrating cardiac trauma: case report. Arch Turk Soc Cardiol. 2003;31:705–9.

3. Topcuoglu MS, Poyrazoglu HH, Yaliniz H. A unusual case of right lung and right atrio-inferiocaval injury caused by stabbing. Thorac Cardiovasc Surg. 2009;57:248–9.

4. Miranda D, Peter AA, Osorio J, Ferreira AC. Ruptured aneurysm of the noncoronary sinus of Valsalva. Tex Heart Inst J. 2005;32:586–8.

5. Archer TP, Mabee SW, Baker PB, Orsinelli DA, Leier CV. Aorta–left atrial fistula: a reversible cause of acute refractory heart failure. Chest. 1997;111:828–31.